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Roadmap Review

Overview of this Presentation

- *Roadmap Process*
- *Organization and Membership*
- *Current Status of Working Groups*
  - *TWGs: Concept Screening Reports*
  - *EMG, FCCG and NTDG Activities*
  - *Schedules*
- *Crosscut Groups*
- *The Roadmap Report*

Approach: First Steps

Derive technology goals based on industry needs

- ***Goals have been drafted by GRNS with GIF comment***
- ***Goals captured in Technology Goals Document***

Plan the activity

- ***Roadmap Development Guide drafted by Roadmap Integration Team***
- ***Working groups have been convened***
- ***International participation fully underway***

Determine how to measure concepts against goals

- ***Conducted by Evaluation Methodology Group***
- ***Develop metrics for each goal***
- ***Develop Screening and Evaluation Reports***

Next Steps: Identify Concepts

Identify concepts for evaluation

- ***Concepts adopted or synthesized by TWGs***
- ***Drawn from a broad international survey***
- ***Substantial international participation***

Detail the most promising concepts

- ***Active study and comparison of underlying technology***
- ***Interactions between TWGs & concept teams/advocates***
- ***Evaluations guided by EMG***
- ***Concepts captured in Concept Reports***

The Final Year: Evaluate & Assemble

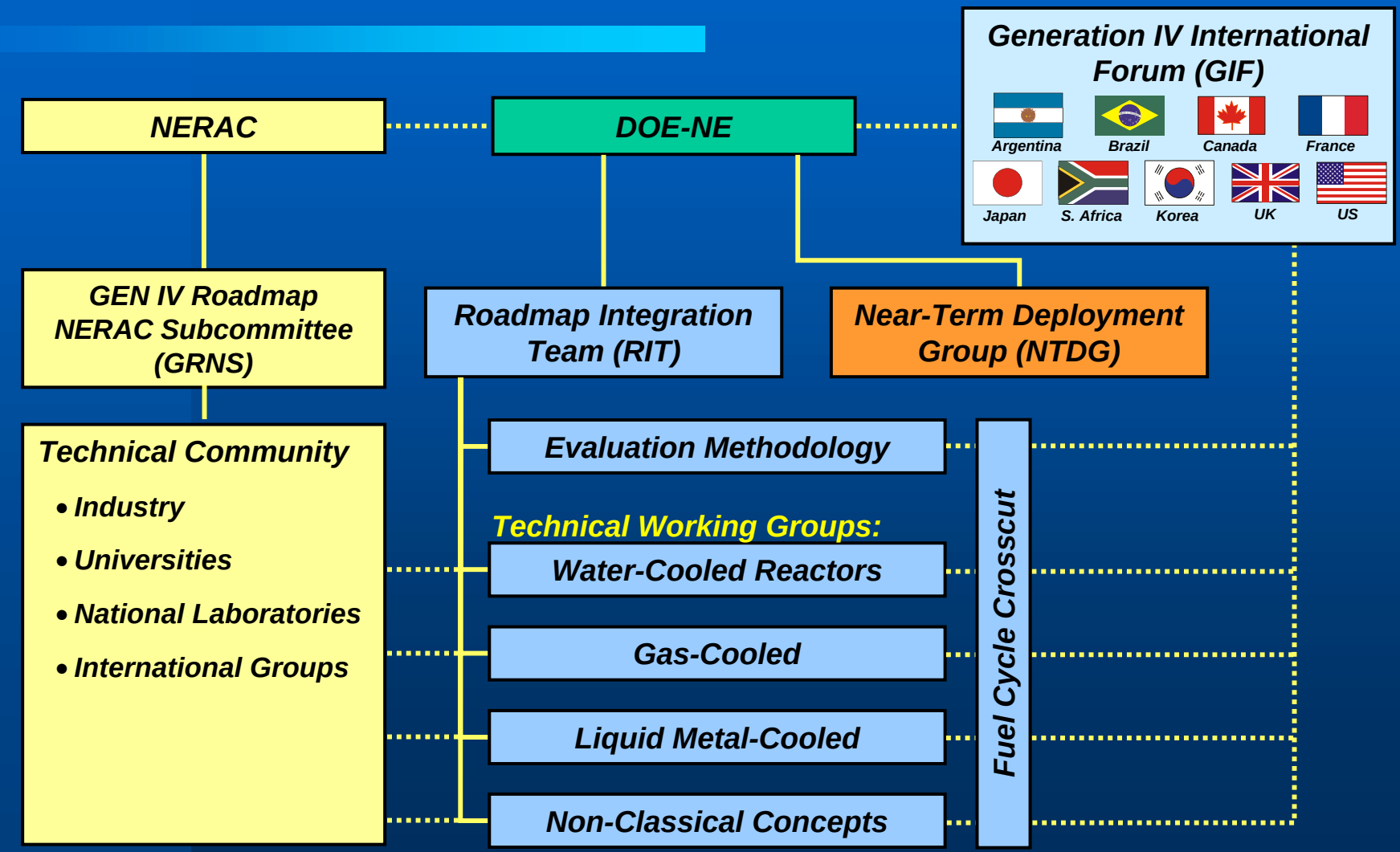
Evaluate the most viable concepts

- *Compare concept performance to goals*
- *Identify technology gaps*
- *Capture needed R&D in R&D Scope Reports*
- *TWGs lead – RIT/EMG reviews – DOE approves – GIF endorses*

Assemble roadmap to support the most promising concepts

- *Identify R&D needs in concept and crosscutting areas*
- *Assemble a program plan with recommended phases*
- *Groups report – RIT integrates – DOE approves – GIF endorses*

Overall Roadmap Organization



Gen IV Roadmap Integration

Roadmap Integration Team (RIT)	
Ralph Bennett (co-Chair)	INEEL
Gian-Luigi Fiorini	CEA
Hussein Khalil (co-Chair)	ANL
John Kotek	ANL
John Ryskamp	INEEL
Rob Versluis (Project Mgr.)	DOE-NE

Current Working Groups

Technical

- TWG 1 Water-Cooled Concepts
- TWG 2 Gas-Cooled Concepts
- TWG 3 Liquid Metal-Cooled Concepts
- TWG 4 Non-Classical Concepts

Special

- Evaluation Methodology Group (EMG)
- Fuel Cycle Crosscut Group (FCCG)
- Near-Term Deployment Group (NTDG)

TWG Membership

- *Co-Chairs on each TWG:*
  - *one from U.S. industry*
  - *one sponsored by GIF*
- *Members:*
  - *About 15 in each group*
  - *about half U.S. and half GIF-sponsored*
- *Special groups have a similar structure*
- *Chairs and members share many responsibilities*

International Members

- *Fully 50% of the TWG group participants are from countries other than the U.S. (42 of 82 members)*
- *IAEA*
  - *Safeguards specialist on EMG*
  - *Members supporting water, gas, metal working groups and fuel cycle crosscut group*
- *NEA*
  - *Economics specialist on EMG*
  - *Fuel cycle specialist on FCCG*
  - *Secretariat function for Gas and Metal working groups is highly effective*

Technology Working Groups 1–4

Charter :

Identify Gen IV concepts for evaluation, evaluate their potential against the goals, their technology gaps and needs, and recommended R&D priority.

Major Products:

Concept Screening for Potential Report

R&D Scope Report

Concept Evaluation Report

Final R&D Report (led by new Crosscut groups)

Evaluation Methodology Group

Charter :

Develop a process for the systematic evaluation of the comparative performance of proposed Gen IV concepts against the established Gen IV goals.

Major Products:

Screening for Potential Methodology Report

Final Evaluation Methodology Report

Viability/Performance Evaluation Methodology Report

Other Important Role:

Review for Consistent Methodology

Fuel Cycle Crosscut Group

Charter:

Examine fuel resource input and waste output from a survey of Generation IV fuel cycles, consistent with projected energy demand scenarios. The survey of fuel cycles will include currently deployed and proposed fuel cycles based on uranium and thorium.

Major Products:

Fuel Cycle Evaluation Report

Other Important Role:

Review for Consistent Scoring & Application of Fuel Cycles

Near Term Deployment Group

Charter:

Identify technological and institutional gaps between the current state-of-the-art and the necessary conditions to deploy new nuclear plants in the U.S. before 2010.

Major Products:

Report on Near-Term Deployment of Reactors in the U.S.

Schedule for Producing the Roadmap

Four Phases over Two Years:

Phase I: Initial work
Oct '00 – Jan '01 – Completed

Phase II: Needs assessment
Jan '01 – Oct '01 – On Schedule

Phase III: Response development
Oct '01 – May '02 – Jan '02 Draft Roadmap
– May '02 Interim Roadmap

Phase IV: Implementation planning
May '02 – Sep '02 – Sep '02 Final Roadmap

Seattle Meeting Highlights

- *Shorter Plenary:*
  - *Status and Issues for the TWG Concept Reports*
  - *Roadmap Outline*
  - *Preview and Discussion of Crosscut Groups*
  - *Assignments for Seattle*
- *Major Assignments at Meeting:*
  1. *Work Concept Report Issues*
  2. *Begin R&D Gap/Needs Identification*
- *Dynamics:*
  - *Excellent meeting attendance*
  - *Growing concern over downselection*

Activities at Quarterly Meetings

	Current Assignment	Look Ahead Assignment
Feb '01	Search for concepts	Draft concept list
May '01	Concept list	Practice screening
Aug '01	Consistent screenings	Draft R&D gaps and needs
Nov '01	R&D gaps and needs	Practice evaluation
Apr '02	Final evaluation	R&D Plan integration
Jun '02	R&D Plan finalization	Final Roadmap reviews

TWG Concept and R&D Scope Reports

- *Organize and describe concept sets*
- *Report results of screening for potential*
- *Identify R&D gaps and needs*

- *The reports are a Foundation for the Roadmap*
  - *Global, well-informed viewpoint*
  - *Authoritative and unbiased scoring*
  - *Effective at communication*

TWG Concept Reports: Status

	Report (pages)	Appendices (pages)
Water–cooled	35	250
Gas–cooled	10	80
Metal–cooled	50	120
Non-Classical	90	25

Key Definitions

Gen IV System:

An entire energy production system, including the nuclear fuel cycle front and back end, the reactor, the power conversion equipment and its connection to the distribution system for electricity, hydrogen, process heat or fresh water, and the infrastructure for manufacture and deployment of the plant.

Concept:

An example of a Gen IV system with enough detail to allow evaluation against the goals, but broad enough to allow for optional features and trades.

Concept Set:

A logical combination of concepts, similar enough to allow for common discussion and evaluation.

Roadmap Concepts

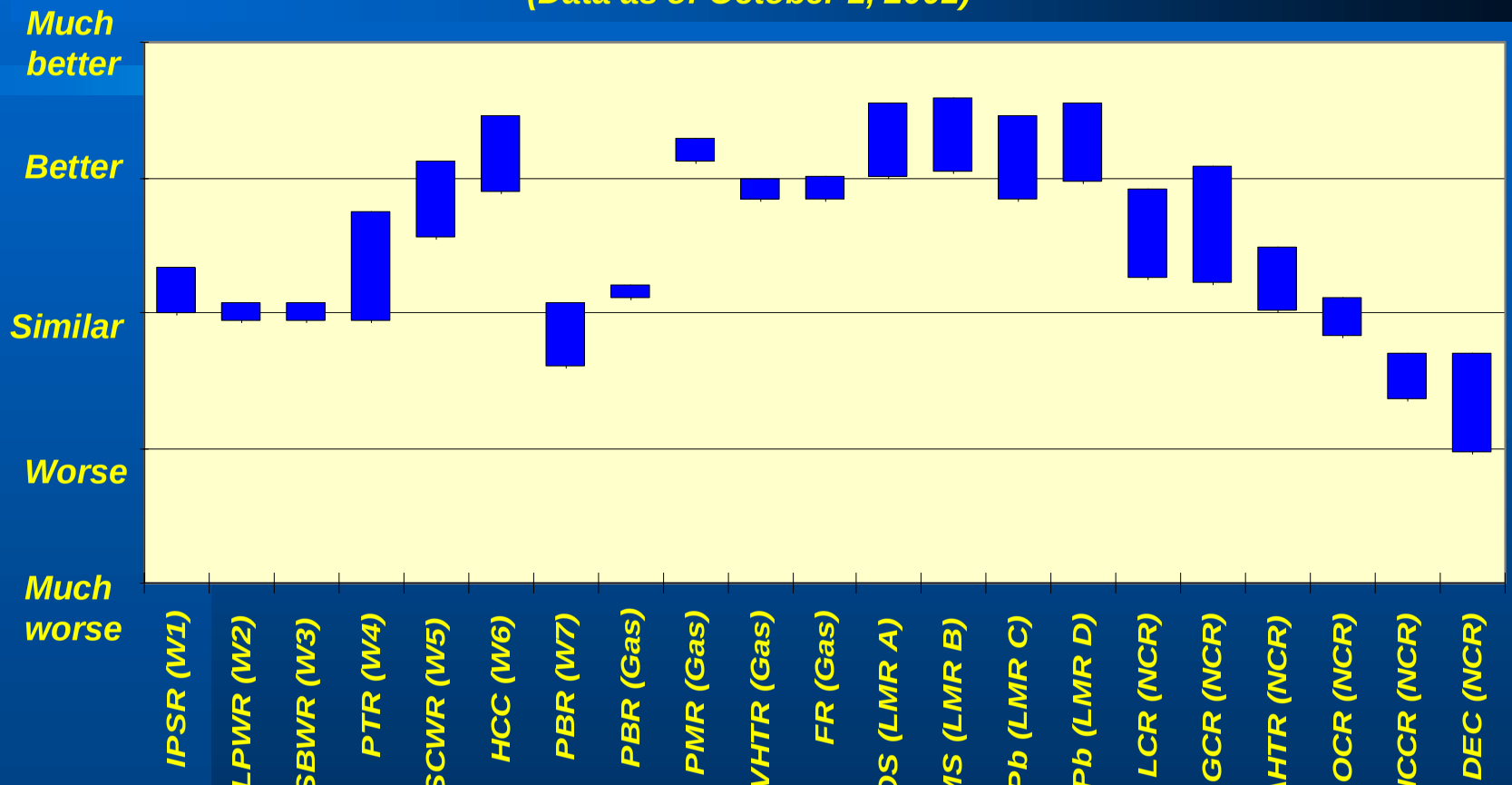
- *Water–Cooled*
  - *Integrated Primary System Reactors* — *IPSR*
  - *Loop PWRs* — *LPWR*
  - *Simplified BWRs* — *SBWR*
  - *Pressure Tube Reactors* — *PTR*
  - *Supercritical Water Reactor* — *SCWR*
  - *High Conversion Cores* — *HCC*
  - *Pebble Fuel Reactor* — *PFR*
- *Gas–Cooled*
  - *Pebble Bed Reactors* — *PBR*
  - *Prismatic Modular Reactors* — *PMR*
  - *Very High Temperature Reactors* — *VHTR*
  - *Fast Gas Reactors* — *FGR*

Roadmap Concepts

- *Liquid Metal–Cooled*
  - *Sodium–Cooled Reactors with MOX fuel* — *LMRA*
  - *Sodium–Cooled Reactors with Metal fuel* — *LMRB*
  - *Lead or Lead/Bismuth Cooled Reactors* — *LMRC*
  - *Sodium–Cooled with Novel Steam Generators* — *LMRD*
- *Non-Classical*
  - *Liquid Core Reactors* — *LCR*
  - *Gas Core Reactors* — *GCR*
  - *Advanced High Temperature Reactor* — *AHTR*
  - *Organic Cooled Reactors* — *OCR*
  - *Non-convectively Cooled Reactors* — *NCCR*
  - *Direct Energy Conversion Reactors* — *DEC*

Screening for Potential - Sustainability

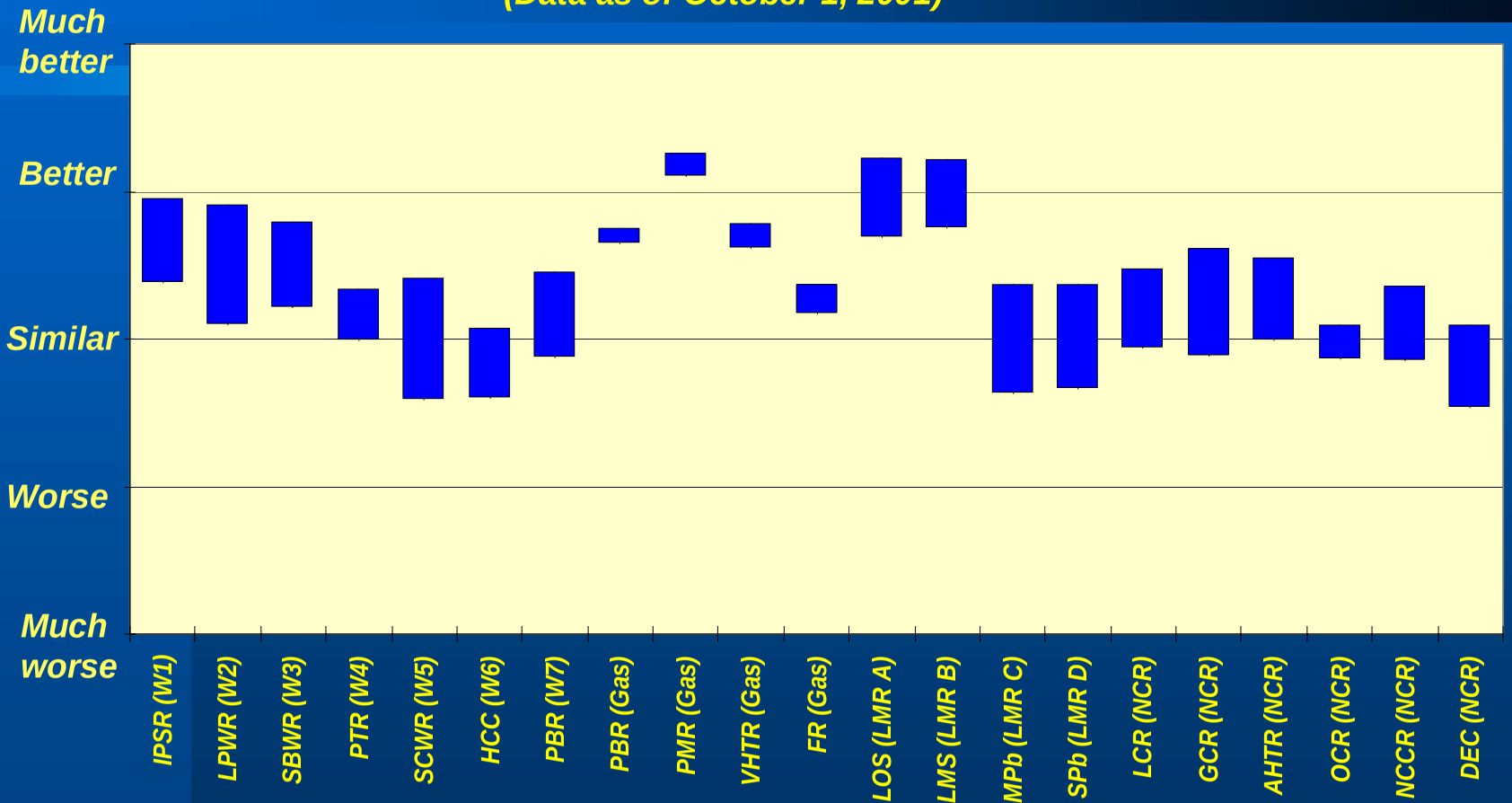
(Data as of October 1, 2001)



Concept Sets

Screening for Potential - Safety & Reliability

(Data as of October 1, 2001)

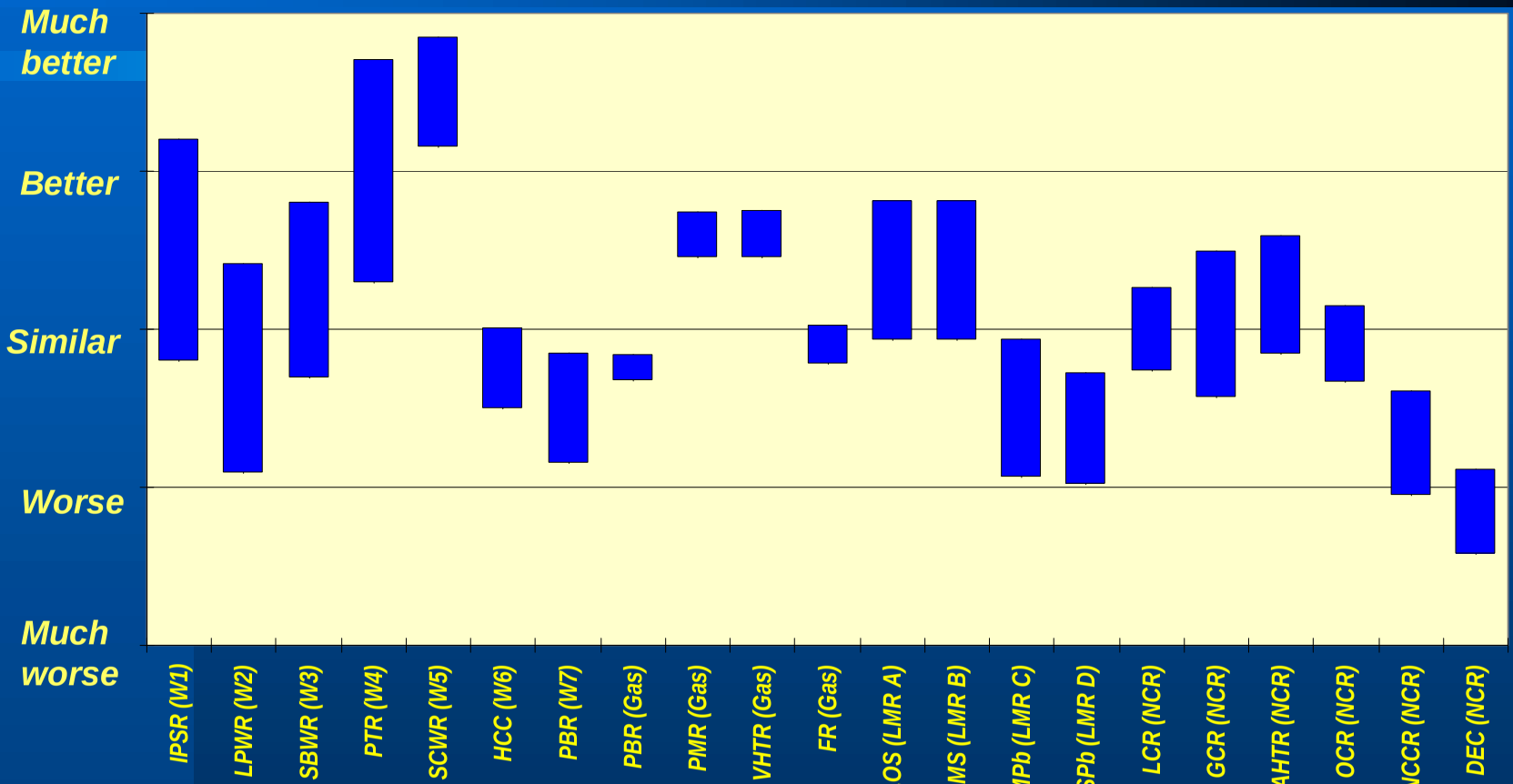


Generation IV

Concept Sets

Screening for Potential - Economics

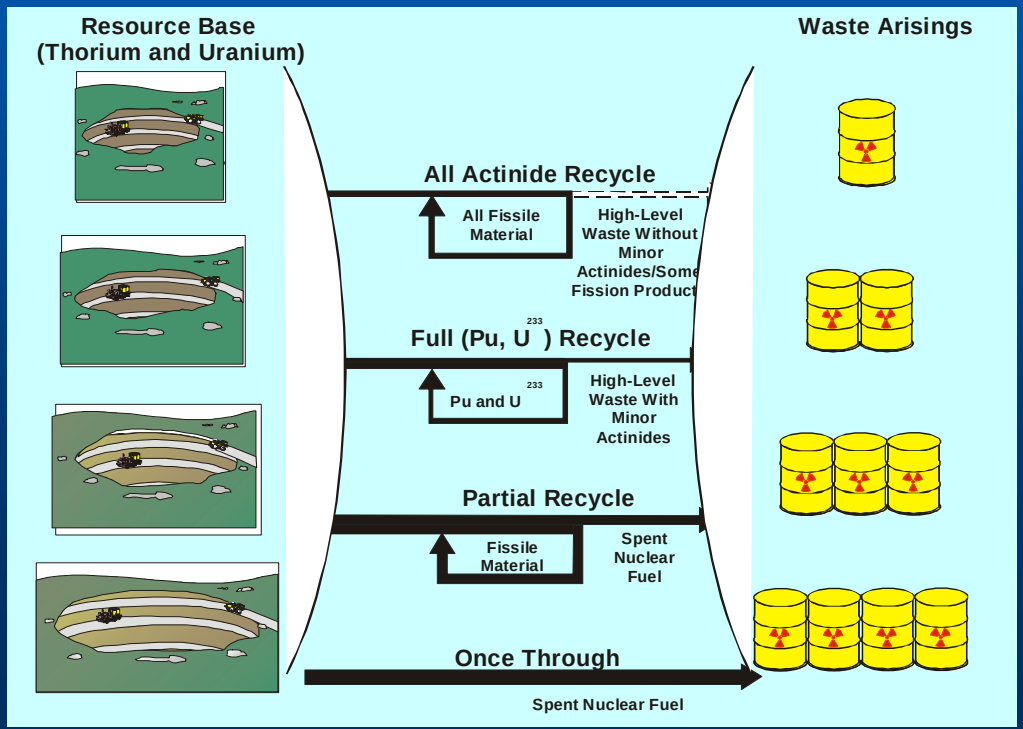
(Data as of October 1, 2001)



Concept Sets

Four Major Fuel Cycle Options Studied

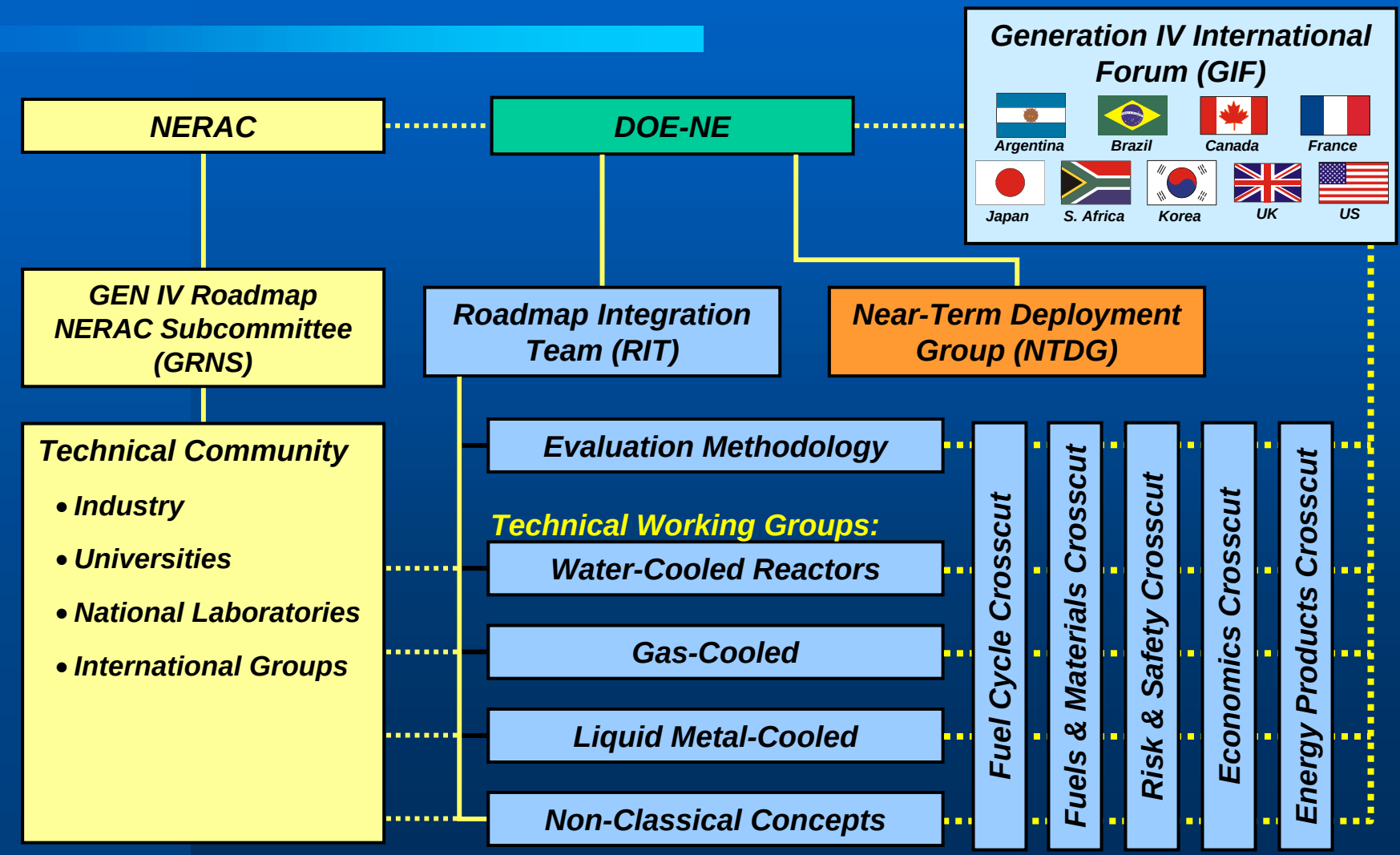
		Examples
Complete Recycle	(Variable, Harvest U+Pu+MA)	Proposed IFR
Multi Recycle	(Variable, Harvest U+Pu)	Proposed EFR
Mono Recycle	(Net TRU Producer, Partial Harvest U+Pu)	European MOX
Once through	(Net TRU Producer, No Harvest)	LWR & CANDU Once Thru



Upcoming Fuel Cycle Crosscut Actions

- *Decide on symbiotic fuel cycles and system alternatives in October 2001, via a two-day meeting of the TWG and FCCG leaders*
- *Review concept scores for consistency*
- *Evaluate symbiotic fuel cycles*
- *Study thorium cycle*
- *Complete activities by March 2002*

Overview of the New Crosscut Groups



R&D Topics in Crosscut Groups

Fuel Cycle

- *Fuel Cycles*
- *Mining*
- *Enrichment*
- *Reprocessing*
- *Trasmutation*
- *Waste disposal*
- *Non-proliferation*

Risk & Safety

- *Static & transient analysis*
- *Design basis analysis*
- *Instrumentation and control*
- *Balance of plant*
- *Probabilisitic risk assessment*
- *Risk-based regulation*
- *Personnel safety*

Economics

- *Economic models*
- *Modularity*
- *Constructability*
- *Standardization*
- *Economics of operation*
- *Power conversion*

Fuels & Materials

- *Fuel, cladding, absorbers*
- *Fabrication*
- *Fuel testing*
- *Spent fuel behavior*
- *Structural materials*
- *Materials compatibility and testing*

Energy Products

- *Electricity*
- *Hydrogen production*
- *Desalination*
- *District & process heat*
- *Cogeneration*

Crosscut Group Work Scope

- *Identify opportunities and objectives for crosscutting R&D*
- *Identify R&D scope and schedule, and estimate costs*
- *Review TWG reports for consistency of scores in crosscut areas*
- *Contribute sections to TWG R&D Scope Reports*
- *Write Joint R&D Planning Report with input from TWGs*

Proposed Roadmap Structure

The Roadmap will be a Two-Part Document

- *Part 1: Roadmap Summary*
  - *Sets the context and summarizes recommendations*
  - *Written for non-technical audience*
- *Part 2: Technical Roadmap*
  - *Provides additional technical descriptions, analysis, and justifications*
  - *Written for nuclear technical audience*

Part One : Roadmap Summary

Executive Summary ***(3 to 5 pages)***

- ***Vision and Approach***
- ***Findings***
- ***Recommendations***

Main Body ***(20-22 pages)***

- ***Introduction and Background***
- ***Approach***
- ***Findings***
- ***Path Forward***

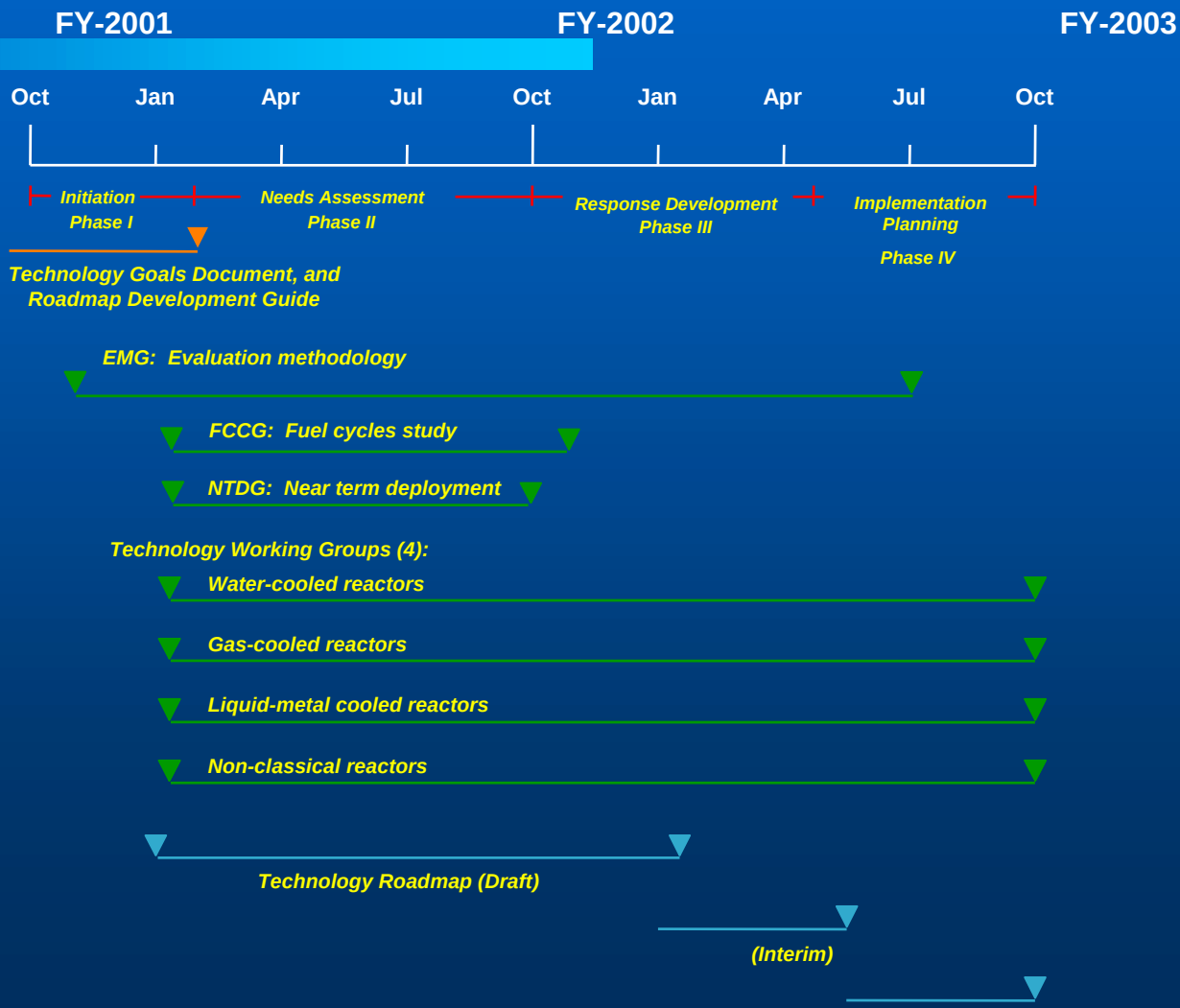
Part Two : Technical Roadmap

- *Presents the synthesis of all technical reports issued by the technical working groups.*
- *Presents a complete and thorough Gen IV rationale, i.e. a review of the important facts used in reaching the conclusions summarized in Part 1 of the Roadmap.*

Technical Roadmap Outline

Sections	Pages
1. Scenarios for Nuclear Energy	5
2. Goals for Generation IV Systems	5
3. System Options (Generation IV and NTD)	10
4. Methodology for System Selection	10
5. Systems Selected for Future R&D	10
6. R&D Needs for Selected Concepts	20
7. R&D Implementation Plan	20
Total Pages	80
APPENDICES : TWG, EMG, NTDG, and Crosscut Group reports	CD-ROM

Milestones on the Two-year Timeline



February, 2000

Summary

- *Excellent international support*
- *Fuel Cycle Crosscut provides a major foundation*
- *Evaluation Methods Group has forged a working consensus for the evaluations*
- *Technical Working Groups have assembled very comprehensive studies*

- *Next six months will be hard work, but the elements are in place for a successful conclusion*